APPENDIX J

OFFSITE EFFECTS OF UNUSUAL RELEASES OF RADIOACTIVE MATERIALS

During preparation of this environmental statement, three incidents of an abnormal nature were investigated. The incidents resulted in some measurable offsite effects, and a brief description of the incidents and associated offsite effects is given in this appendix.

ENVIRONMENTAL EFFECTS OF A TRITIUM GAS RELEASE FROM THE SAVANNAH RIVER PLANT ON MAY 2, 1974

On May 2, 1974, 479,000 curies of tritium gas were released from a tritium processing facility at the Savannah River Plant. The release was caused by a metallurgical failure of a process valve, and tritium was exhausted to the atmosphere by way of a 200-ft-high exhaust stack. The tritium was released over a period of four minutes and mixed with building ventilation exhaust air being discharged at the rate of 130,000 ft^3/min. A public announcement of the release was made via the news media on May 2, 1974, and a detailed report of the environmental effects of the release was published in November 1974.[1]

Light winds of 4 to 6 mph carried the tritium in a northeasterly direction. Analysis of meteorological data indicates that the tritium puff passed out to sea from the North Carolina coast about 36 hours after the release. Measurements of tritium in offplant air indicated that less than 1% was in the oxide form (water vapor). A maximum potential dose to a person from inhalation and skin absorption at the puff centerline at the plant boundary was calculated to be 0.14 mrem. However, actual doses, as determined by urine analyses of persons in the puff trajectory, were less than 0.05 mrem, or less than the dose received in four hours from natural radioactivity. The integrated dose to the population under the puff trajectory was calculated to be 8 man-rem before the tritium passed out to sea.

Over 1000 samples were collected and analyzed following the release. These samples included air moisture, atmosphere hydrogen (and tritium), pine needles, grass, food crops, milk, surface water, rain water, soil, and human urine. Potential individual doses from consumption of tritium-bearing food crops and milk were less than 1 mrem.

ENVIRONMENTAL EFFECTS OF A TRITIUM GAS RELEASE FROM THE SAVANNAH RIVER PLANT ON DECEMBER 31, 1975

On December 31, 1975 at 10:00 P.M., 182,000 curies of tritium gas were released from a tritium processing facility at the Savannah River Plant. The release was caused by the failure of a vacuum gauge and was exhausted to the atmosphere by way of a 200-ft-high stack; about 90% of the tritium was released over a period of 1.5 minutes and was mixed with building ventilation air, which was being discharged at a rate of 130,000 ft^3/min. A public announcement of the release was made on January 1, 1976 via the news media, and a detailed report[2] of the environmental effects was published in March 1976.

Winds averaging 20 mph carried the tritium toward the east. Calculations indicate that the tritium puff passed out to sea about 35 miles north of Charleston, South Carolina, about seven hours after the release occurred (Figure 2 of DP-1415[2]). Samples from the facility exhaust system indicated that 99.4% of the tritium was in elemental form and 0.6% was in the more biologically active oxide form (water). The maximum potential dose to a person (from inhalation and skin absorption) at the puff centerline on the plant boundary was calculated to be 0.014 mrem, about 0.01% of the annual dose received from natural radioactivity. The integrated dose to the population under the release path (approximately 40,000 people) was calculated to be 0.2 man-rem before the tritium passed out to sea.

Over 300 environmental samples were collected and analyzed following the release. These samples included air moisture, atmospheric hydrogen, vegetation, soil, surface water, milk, and human urine. Positive results were found in some on-plant and plant perimeter vegetation samples and aided in confirming the close-in puff trajectory. Tritium concentrations in nearly all samples taken beyond the plant perimeter fell within normal ranges; urine samples indicated no tritium uptakes as a result of the release. Two milk samples did indicate a measurable tritium uptake; the maximum potential dose to an individual drinking this milk was calculated to be about 0.1 mrem.

SAVANNAH RIVER SWAMP CONTAMINATION

Surface streams on the SRP site serve both as natural drainoff for the site and discharge points for industrial effluents. The streams have well-defined entry points into the Savannah River when the river stage is below flood level. All the streams enter and traverse the Savannah River Swamp before entering the Savannah River. As the creeks enter the swamp, flow channels broaden, water velocity decreases, and heavier water-borne sediments settle and

form fluvial deposits. During periods of high water flow, the river overflows its natural banks into the Savannah River Swamp. This condition occurs an average of 23% of the time each year, mostly during the months of January through April.

When the swamp is flooded, the water flow from SRP surface streams generally follows a path in the swamp paralleling the main river channel and bordering the north swamp margin. The swamp flow does not enter the main river channel until high ground is encountered at Little Hell Landing, approximately four miles from the SRP boundary. Water flow velocity in the flooded swamp is low compared to velocities in the main river channel and in the on-site SRP surface streams. Under this condition, some water-borne sediments settle and deposit in the swamp. During the 1960s, small amounts of radioactive materials from SRP releases were deposited in about 1.7 square miles offsite swamp downstream from SRP. The maximum annual concentration of radionuclides occurred in Steel Creek in 1964. Cesium-137 concentration in Steel Creek was 3% of the concentration guide (ERDAM 0524) for uncontrolled areas in that year.

Associated with the deposit in the off-site swamp were approximately 25 curies of cesium-137 (^{137}Cs) and less than 1 curie of cobalt-60 (^{60}Co). Most of the ^{137}Cs and ^{60}Co in the swamp was from releases from L and P reactor fuel storage basins to Steel Creek. The discharges to Steel Creek were substantially reduced in 1970 following modifications to one reactor and shutdown of the other reactor.

Aerial radiological surveys and ground surveys conducted in 1974[3-5] revealed that approximately 4.8 Ci of ^{137}Cs and most of the ^{60}Co was deposited in a quarter-mile long section of swamp (43 acres) immediately adjacent to the SRP boundary (Figure J-1). The remainder of the detectable radioactivity was deposited in a four-mile-long band bordering the north swamp margin, terminating at the Little Hell Landing area. A public announcement was made on September 4, 1974, regarding the small amount of radioactivity found in the swamp.

Swamp sediment analysis showed that about 70% of the ^{137}Cs was in the top two and one-half inches of soil and the remaining portion was detectable to a depth of 10 inches. The maximum ^{137}Cs concentration measured in soil was 527 pCi/g. Shallow-rooted vegetation contained a maximum cesium concentration of 235 pCi/g; deeper-rooted overstory trees contained lower concentrations. Water-fowl, fish, deer, and other wildlife caught in or near the swamp had only low levels of ^{137}Cs, ranging from 4 to 10 pCi/g. These concentrations are about the same as those resulting from worldwide weapons test fallout elsewhere in the southeastern United States.

Gamma radiation exposure rates ranged from 6 to 120 μR/hr above background in affected areas of the swamp. The probable incremental radiation dose above background to hunters and fishermen who spend a few hours to a few hundred hours in the swamp would range from less than 1 mR to a few tens of mR per year. A hypothetical person (none exists) who resides in the swamp when it is not flooded (an average of 77% of the time) could receive annual doses exceeding 500 mR, with a maximum possible dose of about 800 mR, in only 0.25 to 0.5 acre of swamp having the highest level of radioactivity deposition. No restrictions on use of the swamp are considered warranted nor are remedial actions needed.

The contaminated sediments are relatively immobile and are expected to remain so. No increase in exposure rate is expected from current releases of radioactivity. However, the swamp will be monitored at least annually in the future to provide a basis for continued evaluation.

REFERENCES FOR APPENDIX J

1. W. L. Marter. *Environmental Effects of a Tritium Gas Release from the Savannah River Plant on May 2, 1974.* USAEC Report DP-1369, E. I. du Pont de Nemours and Co., Savannah River Laboratory, Aiken, SC (1974).

2. W. R. Jacobsen. *Environmental Effects of a Tritium Gas Release from the Savannah River Plant on December 31, 1975.* USERDA Report DP-1415, E. I. du Pont de Nemours and Co., Savannah River Laboratory, Aiken, SC (1976).

3. W. L. Marter. *Radioactivity from SRP Operations in a Downstream Savannah River Swamp.* USAEC Report DP-1370, E. I. du Pont de Nemours and Co., Savannah River Laboratory, Aiken, SC (1974).

4. W. L. Marter. *Gamma Exposure Rates in the Steel Creek and Little Hell Landing Areas.* DPST-74-551, E. I. du Pont de Nemours and Co., Savannah River Laboratory, Aiken, SC (1975).

5. P. K. Boyns. *Aerial Radiological Survey of the Savannah River Plant (Aiken, South Carolina). Date of Survey: 2-25 June 1974.* USERDA Report EGG-1183-1165, EG and G, Inc., Las Vegas, NV (1975).

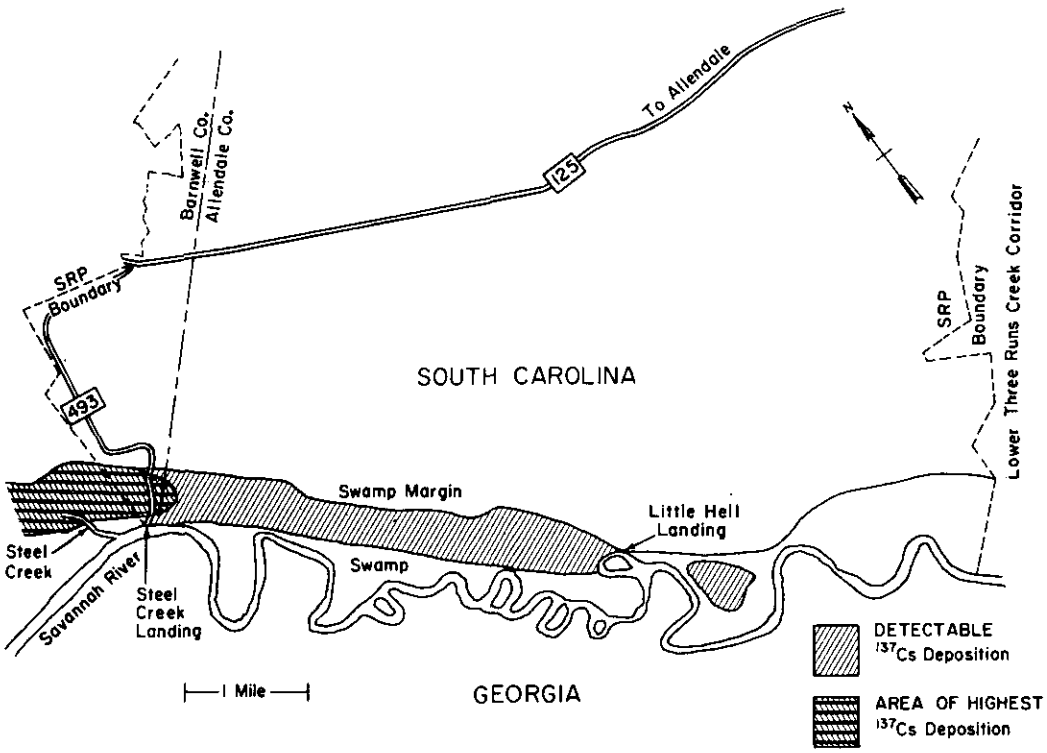

FIGURE J-1. Radioactivity Deposition in the Savannah River Swamp